

ABSTRACT OF THE DISCLOSURE

A diffraction based overlay metrology system produces the overlay error independent of effects caused by local process variations. Generally, overlay patterns include process variations that provide spectral contributions, along with the overlay shift, to the measured overlay error. The contributions from process variations are removed from the determined overlay error. In one embodiment, the local process variations are removed by measuring the overlay pattern before and after the top diffraction gratings are formed. A plurality of differential spectra from the measurement locations of the completed overlay pattern can then be used with a plurality of ratios of differential spectra from measurement locations of the incomplete overlay pattern can then be used to determine the overlay error by either direct calculation or by fitting techniques. In another embodiment, the local process variations are removed with no premeasurement but with careful construction of the overlay patterns.